DOCUMENT RESUME

ED 263 428 CE 042 976

TITLE	Math on the Job. Sheet-Metal Worker.
INSTITUTION	Ohio State Univ., Columbus. National Center for Research in Vocational Education.
SPONS AGENCY	Office of Special Education and Rehabilitative Services (ED), Washington, DC.
PUB DATE	85
GRANT	G008300003
NOTE	26p.; For the other booklets in this series, see CE 042 963-994.
PUB TYPE	Guides - Classroom Use - Materials (For Learner) (051)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Blueprints; *Career Awareness; Career Education; *Disabilities; Emotional Disturbances; Enrichment Activities; Equipment Utilization; Learning Disabilities; *Mathematics Skills; Mental Retardation; *Metal Working; Occupational Information; Secondary Education; *Sheet Metal Work; Skill Development; Special Education; *Work Environment

ABSTRACT

This booklet is intended to help mainstreamed mentally retarded, emotionally disturbed, or learning disabled high school students acquire a basic understanding of the responsibilities and working conditions of sheet metal workers and to practice basic math skills necessary in the occupation. The first section provides a brief introduction to the occupation by focusing upon those job tasks of a sheet metal worker with which the student is likely to be familiar. The next two sections deal with the work environment of the typical sheet metal worker and the training, education, and experience needed for the occupation. Exercises addressing basic math skills used by sheet metal workers are provided. Various suggestions are listed for students interested in further exploring the occupation of sheet metal worker. A glossary and answer sheet conclude the booklet. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED263428

MATH on the job

Sheet-Metal Worker

CE042996

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Harris

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

THE NATIONAL CENTER MISSION STATEMENT

The National Center for Research in Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The National Center fulfills its mission by:

- Generating knowledge through research
- Developing educational programs and products
- Evaluating individual program needs and outcomes
- Installing educational programs and products
- Providing information for national planning and policy
- Operating information systems and services
- Conducting leadership development and training programs

MATH ON THE JOB:

SHEET METAL WORKER

Copyright © 1985. The National Center for Research in Vocational Education of The Ohio State University. All Rights Reserved.

This publication was prepared pursuant to a grant from the Office of Special Education and Rehabilitation Services, U.S. Department of Education. Grantees undertaking such projects under Government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official U.S. Department of Education position or policy.

MATH on the job

Sheet-Metal Worker

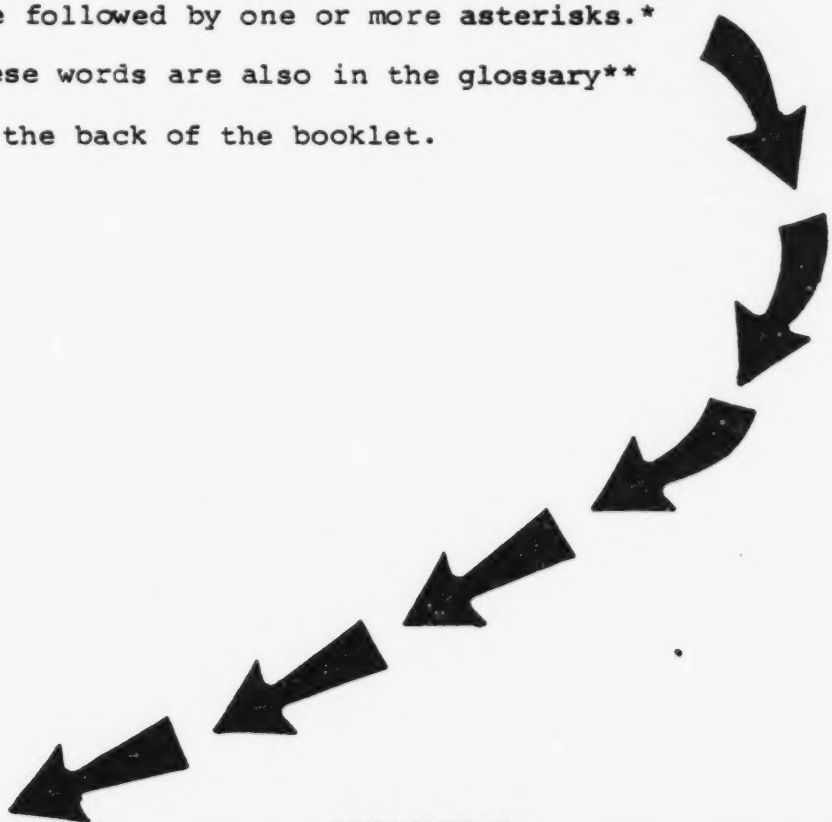
In this booklet, you can--

- find out what a sheet metal worker does
- see how a sheet metal worker uses math
- get a chance to use math as a sheet metal worker
- find out the types of things a sheet metal worker needs to know
- find out what courses, training, and experience you need to become a sheet metal worker

SPECIAL WORDS USED IN THIS BOOKLET

Workers in many jobs use special words or special meanings for words. Learning these words helps you to learn about a job.

You will find some of these special words in this booklet. When these words, and some hard words, are used for the first time, they are followed by one or more **asterisks.*** These words are also in the **glossary**** at the back of the booklet.



DEFINITIONS

*An asterisk (*) is a symbol that tells you to look at the bottom of the page for the meaning, or definition, of the word.

**A glossary is a list of words with their meanings.

CONTENTS

HAVE YOU EVER? 1

WHAT DOES A SHEET METAL WORKER DO? 2

WHERE DOES A SHEET METAL WORKER WORK? 8

WHAT TRAINING, EDUCATION, AND EXPERIENCE DO YOU NEED TO BECOME A SHEET METAL WORKER? 12

DO YOU WANT TO DO MORE SHEET METAL WORKER'S MATH? . 14

DO YOU WANT TO EXPLORE SOME MORE? 16

GLOSSARY 17

ANSWER SHEET 18

HAVE YOU EVER...

- watched someone put metal siding or roofing on a house?
- watched someone install a furnace or air-conditioning system?
- helped someone put up metal kitchen cabinets?
- helped someone repair a leaky **rainspout***?

If you have, then you have some idea about the work of a sheet metal worker. This booklet will help you learn about the work of a sheet metal worker and how math is important to do the job.

DEFINITION

*A rainspout is a pipe that carries rainwater from the gutter of a building to the ground.

WHAT DOES A SHEET METAL WORKER DO?

Most sheet metal workers make, install, repair, and **alter*** **ducts**** used for heating, ventilating, and air-conditioning systems. How does a sheet metal worker make and install ductwork? As a sheet metal worker, you--

- read a **blueprint***** or drawing of the sheet metal product to be made
- pick out the size and type of sheet metal to be used
- use a blueprint or drawing to make measurements and determine angles
- mark measurements and angles on a sheet of metal. This is the pattern of the product to be made.
- cut out the pattern with hand or power shears
- drill or punch holes where needed
- assemble the parts by welding, soldering, bolting, or riveting them together
- install the completed unit by welding, bolting, screwing, or nailing it into place

DEFINITIONS

*To **alter** something means to make it different; to change something.

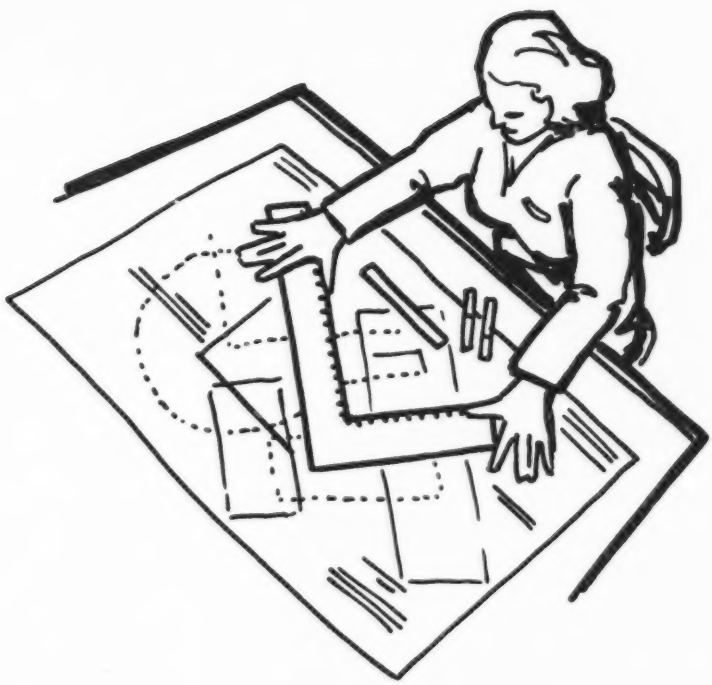
**A duct is a pipe, tube, or channel that carries or conveys something such as heated air or wiring. In a house, a duct may carry heated air from the furnace to different rooms of the house. A duct may also carry wiring from the basement power supply room to each room of the house.

***A blueprint is a picture that shows how something is to be built or put together.

Sheet metal workers use math in their work every day.

As a sheet metal worker, you--

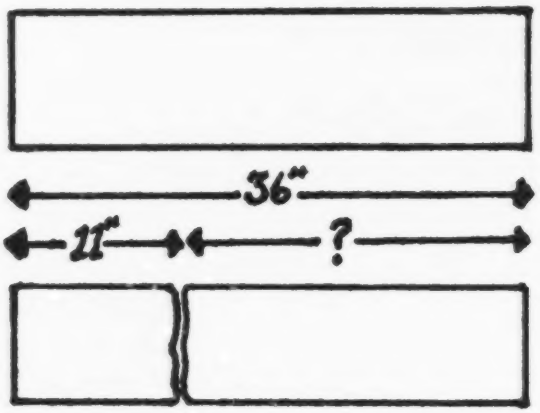
- count, add, subtract, multiply, and divide
- use whole numbers, decimals, and fractions
- read measuring instruments such as rulers, tape measures, and micrometers
- read blueprints and scale drawings
- convert measurements on a blueprint or scale drawing to actual size



A sheet metal worker uses math to measure length.

EXAMPLE

A sheet metal worker must be able to work with measurement. From a sheet of metal 36" long, a sheet metal worker cut 13". How many inches of sheet metal remained? To find this amount, you must subtract 13" from 36".



The sheet metal worker had 23" of sheet metal left over.

NOW YOU TRY IT

Practice Exercise A

1. A sheet metal worker has a 43" long sheet of metal. The assignment was to cut a piece 14" long. How long was the sheet of metal that was left over?

2. From a piece of sheet metal 57" long, a sheet metal worker cut 28". How long was the sheet of metal that was left over?

3. A sheet metal worker has two pieces of sheet metal. One is 6'5" long and the other is 5'8". How much sheet metal is there altogether?

12

A sheet metal worker uses math to figure out the cost of materials.

EXAMPLE

The cost of one box of machine screws is $0.97. If a sheet metal worker orders 32 boxes, what is the cost? To find the cost, multiply the cost per box by the number of boxes:

$0.97 x 32 = $31.04

The cost for machine screws is $31.04.

NOW YOU TRY IT

Practice Exercise B

4. A sheet metal worker orders 75 boxes of machine screws at $0.97 a box. What is the cost?

5. If the cost of one box of rivets is $1.12, what is the cost of 22 boxes?

6. A sheet metal worker orders 15 square feet of sheet metal at $0.37 per square foot. What is the cost?

A sheet metal worker uses math to calculate thickness.

EXAMPLE

If one sheet of metal is 0.4 centimeter (cm) thick, how thick is a stack of sheet metal with 10 sheets? To find this amount, multiply the thickness of one sheet by the number of sheets in the stack:

0.4 cm x 10 = 4.0 cm

The stack of sheet metal is 4.0 centimeters (cm) thick.

NOW YOU TRY IT

Practice Exercise C

7. If one sheet of metal is 0.3 cm thick, how thick is a stack of sheet metal with 12 sheets?

8. One sheet of metal is 0.7 cm thick. How thick is a stack with 436 sheets?

9. A stack of sheet metal contains 899 sheets. Each sheet is 0.4 cm thick. How thick is the stack?

A sheet metal worker uses math to keep track of production.

EXAMPLE

Some sheet metal workers are paid by the number of pieces of metal parts on which they worked. This is called piece work. To find their gross income, these employees multiply the rate per piece by the total number of pieces on which they worked.

Pieces worked on x Rate per piece = Gross income

John Beagle worked on a total of 488 pieces in one week. If the rate per piece is $0.34, what was John's gross income for that week?

To find the amount, multiply the number of pieces worked on by the rate per piece:

488 x .34 = $165.92

John's gross income for that week was $165.92.

NOW YOU TRY IT

Practice Exercise D

Find the gross income for each employee listed below.

Employee Name	Pieces Worked on	Rate per Piece	Gross Income
10. Julie Washington	503	.34	?
11. George Simms	467	.34	?
12. Ann Peters	282	.65	?
13. David Cobb	411	.36	?
14. Harry Draper	157	.98	?

WHERE DOES A SHEET METAL WORKER WORK?

As a sheet metal worker, you may work in a sheet metal shop or on a construction site. In a sheet metal shop, you will work with other sheet metal workers. You will have a shop supervisor who shows you what to do. On a construction site, you will work with construction workers as well as other sheet metal workers. You will have a site supervisor who shows you what to do. At both the sheet metal shop and construction site, your supervisor will check your work.

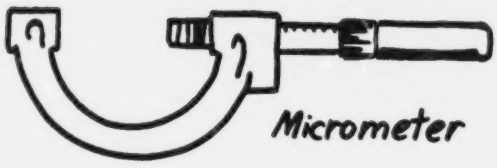
To be a sheet metal worker, you should be able to work well under different conditions.

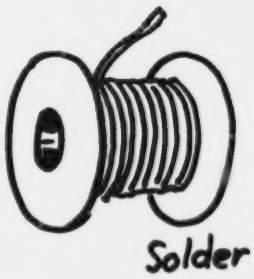
As a sheet metal worker, you may work for one of several firms. All of these firms are involved in the making and installing of heating, ventilating, and air-conditioning systems. You may work for a--

- general contractor who builds residential, commercial, or industrial buildings
- roofing, sheet metal, or air-conditioning and heating contractor
- government agency or business that does its own construction and alteration work

Sheet metal workers use special types of equipment to perform their work. As a sheet metal worker, you use--

- tape measures, rulers, and **micrometers*** for measuring sheet metal and laying out the work
- sheet and plate **gauges**** for measuring the thickness and weight of sheet metal
- hand shears, hack saws, and power saws for cutting
- specially designed, heavy steel presses and shears for cutting, bending, and shaping
- bolts, cement, rivets, and **solder***** for fastening seams and joints together
- hammers, shears, and drills for making parts by hand at the worksite and for altering parts made in the shop





DEFINITIONS

*A micrometer is a measuring instrument used to make small, precise measurements.

**A gauge is a measuring instrument used to measure thickness and weight. Thickness is measured in units called gauges. For example, a piece of sheet metal measuring 1/32" in thickness is called 22 gauge sheet metal.

***Solder is a soft metal. A torch is used to melt the solder. This melted solder flows between the joints and fastens them together.

IF YOU ARE INTERESTED IN

THE WORK OF A SHEET METAL WORKER

AND WOULD LIKE TO KNOW MORE,

READ ON

WHAT TRAINING, EDUCATION, AND EXPERIENCE DO YOU NEED TO BECOME A SHEET METAL WORKER?

What do you think? Would you like to be a sheet metal worker? If you would, there are some things you should know.

To get a job as a sheet metal worker, you need to know how to--

- do arithmetic
- use many kinds of equipment such as hand tools and power machines
- read blueprints and scale drawings
- work well with others
- work well without close supervision

The best way to learn these things is to take courses in metal shop, mechanical drawing, and mathematics at your high school.

To be a sheet metal worker, you should be a high school graduate. After high school, you must enter either an apprenticeship program or an on-the-job training program. In an apprenticeship program, you will work on different sheet metal jobs totalling 8,000 hours of work experience. At the same time, you will attend classes. In these classes, you will learn about sheet metal workers and the work they do. Apprenticeship programs may take up to four years and you are paid for the work you do.

In an on-the-job training program, you will help experienced sheet metal workers do their work. They will show you what to do and train you on the job. You may have to get additional training at a trade or technical school. On-the-job training programs may take up to five years, and you are paid for the work you do.

Taking every chance to learn new skills and tasks will help you do a better job. Good math skills will also help you perform your work as a sheet metal worker.

DO YOU WANT TO DO MORE SHEET METAL WORKER'S MATH?

Practice Exercise E

13. A sheet metal worker has a sheet of metal 81" long. The assignment is to cut a piece 39" long. How long is the sheet of metal that is left over?

14. From a piece of metal 3'10" long, a sheet metal worker cut 2'8". How long was the sheet of metal that was left over?

15. From a piece of sheet metal 2'8" long, a sheet metal worker cut 1'9". How long was the sheet of metal that was left over?

Practice Exercise F

16. A sheet metal worker orders 89 boxes of machine screws at $0.76 a box. What is the cost?

17. If the cost of one box of rivets is $1.26, what is the cost of 19 boxes?

18. A sheet metal worker orders 34 square feet of sheet metal at $0.55 per square foot. What is the cost?

Practice Exercise G

19. If one sheet of metal is 0.4 cm thick, how thick is a stack of sheet metal with 13 sheets?

20. One sheet of metal is 0.9 cm thick. How thick is a stack with 576 sheets?

21. A stack of sheet metal contains 82 sheets. Each sheet is 0.3 cm thick. How thick is the stack?

Practice Exercise H

Find the gross income for each employee listed below. Use the formula given.

Pieces worked on x Rate per piece = Gross income

	Employee Name	Pieces Worked on	Rate per Piece	Gross Income
22.	Rita Rivers	250	.57	?
23.	Chris Turner	478	.32	?
24.	Carlos Sinclair	422	.43	?
25.	Robert Rydell	297	.75	?

DO YOU WANT TO EXPLORE SOME MORE?

1. Visit a sheet metal shop. Watch the sheet metal workers do their jobs. Write down the tasks you see them perform. Would you like to do these tasks?

2. Visit a construction site. Watch the sheet metal workers do their jobs. Write down the tasks you see them perform. Would you like to do these tasks?

3. Talk with two or three sheet metal workers. Ask them what tasks they perform on the job. Ask them about their training and experience. Ask them what things they like and dislike about their job.

4. Call, write, or visit the union for sheet metal workers in your community. Ask how you can get into an apprenticeship program. Ask what courses you should take in high school to help you become a sheet metal worker.

5. Talk to your high school counselor. Ask if your school offers a vocational program in sheet metal work. If it does, talk to the instructor of the class. Ask if you may visit the class. Talk to the other students in the class. Ask them why they want to be sheet metal workers. Ask them how they use math in their sheet metal classes.

5. Are you interested in other jobs which are like sheet metal work?

   - Coppersmiths make, install, and repair equipment and materials made of copper
   - Sheet metal lay out workers find and mark dimensions and reference lines on sheet metal
   - Metal roofers install and repair metal roofs
   - Metal products fabricators make and assemble metal products such as windows, doors, and awnings
   - Metal patternmakers lay out, drill, grind, fit, and assemble castings and parts to make patterns for metal products

   You must have good math skills to do these jobs well. Most of these workers add, subtract, multiply, and divide every day on the job.

GLOSSARY

Alter: to make something different; to change something.

Asterisk (*): a mark that tells you to look at the bottom of the page for the meaning, or definition, of the word.

Blueprint: a picture that shows how something is to be built or put together.

Duct: a pipe, tube, or channel that carries or conveys something such as heated air or wiring.

Gauge: a measuring instrument used to measure thickness and weight. Thickness is measured in units called gauges. For example, a piece of sheet metal measuring 1/32" in thickness is called 22 gauge sheet metal.

Glossary: a list of words with their meanings.

Micrometer: a measuring instrument used to make small, precise measurements.

Rainspout: a pipe that carries rainwater from the gutter of a building to the ground.

Solder: a soft metal. A torch is used to melt the solder. This melted solder flows between the joints and fastens them together.

ANSWER SHEET

Practice Exercise A

1. 29"
2. 29"
3. 12'1"

Practice Exercise B

4. $72.75
5. $24.64
6. $5.55

Practice Exercise C

7. 3.6 cm
8. 305.2 cm
9. 359.6 cm

Practice Exercise D

10. $171.02
11. $158.78
12. $183.30
13. $147.96
14. $153.86

Practice Exercise E

13. 42"
14. 1'2"
15. 11"

Practice Exercise F

16. $67.64
17. $23.94
18. $18.70

Practice Exercise G

19. 5.2 cm
20. 518.4 cm
21. 24.6 cm

Practice Exercise H

22. $142.50
23. $152.96
24. $181.46
25. $222.75